AmerGen
An Exelon Company

Clinton Power Station
R. R. 3, Box 228
Clinton, IL 61727

10 CFR 50.73

U-603789
October 23, 2006

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Licensee Event Report 2006-003-00

Enclosed is Licensee Event Report (LER) No. 2006-003-00: High Reactor Water Level Scram Result of Bad Inverter Circuit Board Solder Joint. This report is being submitted in accordance with the requirements of 10 CFR 50.73.

Should you have any questions concerning this report, please contact Mr. Ronald Frantz, Sr. Regulatory Specialist, at (217)-937-2813.

Respectfully,

Bryan Hanson
Site Vice President
Clinton Power Station

RSF/blf

Enclosures: Licensee Event Report 2006-003-00
Summary of Commitments

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety – IEMA Division of Nuclear Safety

IE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE
High Reactor Water Level Scram Result of Bad Inverter Circuit Board Solder Joint

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									None	05000
08	27	2006	2006	- 003 -	00	10	23	2006	None	05000

9. OPERATING MODE
1

10. POWER LEVEL
96.7

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☒ OTHER (10 CFR 21)

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
M. D. Stickney, Maintenance Programs Specialist	(217) 937-3421

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	EF	INVT	E209	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On 8/27/06, the station experienced a momentary loss of safety-related Division 4 Nuclear System Protection System (NSPS) inverter resulting in an automatic reactor scram on high reactor water level. The event cycled the safety-related 120 Volts Alternating Current (VAC) NSPS bus causing the Division 3 emergency diesel generator, the Division 3 shutdown service water system, and the High Pressure Core Spray System (HPCS) to automatically start, and HPCS to inject water into the reactor vessel. The loss of inverter also caused the "A" Reactor Recirculation (RR) pump to trip. The loss of the RR pump combined with the HPCS injection caused reactor vessel water level to increase to the high reactor water level trip. The cause of the momentary loss of the inverter was an intermittent failure of an inadequate solder joint in the Division 4 NSPS inverter. The solder joint is located on the backplane circuit board, and is a common node for both inverter and bypass transformer sources of power. Failure of the connection resulted in a loss of power to the safety-related 120 VAC bus. Corrective action includes replacement of the circuit board in the Division 4 inverter and the same board in the Division 3 inverter, and revising the purchasing description for the backplane circuit boards to disallow boards of this vintage. This event is reportable under 10CFR 21.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

Unit: 1 Event Date: 8/27/06 Event Time: 1705 Central Daylight Time

Mode: 1 (Power Operation) Reactor Power: 96.7 percent

DESCRIPTION OF EVENT

On August 27, 2006, at 1704:38 hours, with the unit at 96 percent power, the station received an alarm [ALM] for failure of Nuclear Systems Protection System (NSPS) [EF] 120 Volts Alternating Current Logic "D" power, indicating a loss of the Division 4 NSPS inverter [INVT] power output and the Division 4 NSPS power distribution panel transferred to its alternate power source.

At 1704:39 hours erratic Reactor Protection System (RPS) [JC] operation was experienced as indicated by fluctuations of the "D" Average Power Range Monitor (APRM) [MON] and receipt of a Division 4 RPS half scram signal alarm.

At 1705:04 hours, the Division 4 RPS half scram signal reset, indicating a return of power from the Division 4 NSPS inverter. The fluctuation in NSPS logic power caused a false low reactor pressure vessel water level and high drywell pressure indication for High Pressure Core Spray System (HPCS) [BG] initiation logic, a loss of coolant accident signal and an end of cycle Reactor Recirculation (RR) [AD] pump trip signal.

At 1705:05 hours, HPCS, the Division 3 emergency diesel generator [DG] [EK], and the Division 3 shutdown service water system [BI] pump [P] automatically started, and HPCS started injecting water into the reactor. The trip logic for the "A" RR system pump re-powered causing the pump to trip. By 1705:16 hours, the HPCS injection valve was fully open.

Operators entered off-normal procedures for abnormal reactor coolant flow and abnormal reactor pressure vessel level/loss of feedwater at power and established 48 inches and increasing as the high reactor water level threshold for initiating a manual reactor scram. Reactor water level appeared to be steady at 48 inches, and then made a step change increase.

At 1705:24 hours, the loss of the "A" RR pump combined with the HPCS injection caused reactor vessel water level to increase to the high reactor water level trip (Level 8, 52 inches), resulting in an automatic reactor scram. Operators placed the reactor mode switch [HS] into the "shutdown" position, verified all control rods inserted fully, and entered the Emergency Operating Procedure (EOP) for "RPV Level Control."

Immediately following the scram, reactor water level decreased rapidly due to void collapse to below the low level (Level 3, 8.9 inches) trip. Reactor water level then increased rapidly to above the Level 8 trip setpoint and stabilized at about 55 inches as operators terminated the HPCS

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

injection and feedwater [SJ] pump flow decreased. Reactor water level then decreased and operators maintained level within the Level 3 and Level 8 band in accordance with the off-normal procedure.

At 1705:38 hours, Reactor Core Isolation Cooling (RCIC) system [BN] Division 1 outboard steam isolation valve received a close signal and shut. This isolation did not cause or contribute to the cause of the event described in this LER, and occurred after the reactor scram. Issue Report 524768 was initiated to investigate and correct this item.

At 1808 hours, operators exited the RPV Level Control EOP.

As expected during the event, the Level 3 low reactor water level trip caused primary containment isolation valves [ISV] in Group 2 (Residual Heat Removal (RHR) [BO]), Group 3 (RHR), and Group 20 (miscellaneous systems) to receive signals to shut; operators verified that the valves properly responded to the Level 3 trip.

The plant was stabilized in Mode 3 (Hot Shutdown) using normal balance of plant systems and turbine bypass [JI] valves [V] for pressure control. No safety relief valves lifted during this event.

Issue Report 524365 was initiated to perform a root cause evaluation of the reactor scram and identify corrective actions.

No other inoperable equipment or components directly affected this event.

This event is reportable under the provisions of 10 CFR 50.73(a)(2)(iv)(A).

CAUSE OF EVENT

The reactor scrammed on high reactor water level. The high reactor water level was caused by a combination of HPCS injection and reactor water level swell resulting from loss of the "A" RR pump. The loss of the RR pump and HPCS injection were caused by a relay race within the NSPS system logic during energization of the Division 4 NSPS bus [BU]. The relay race was initiated by re-powering of the Division 4 NSPS inverter. The momentary loss of inverter power was caused by an intermittent solder connection.

The root cause for this event was an intermittent failure of an inadequate solder joint in the Division 4 NSPS inverter. The solder joint is located on the backplane circuit board, and is a common node for both the inverter and the bypass transformer [XFMR] sources of power. The connection is located at a resistor lead that was added to the board as part of a modification performed by Elgar (the inverter supplier) prior to shipment of the inverters to Clinton in 1980. The connection contained an eyelet that was not properly connected to the board trace. The inverter supplier performed a standard refurbishment of the board in 1998, and the board remained in Clinton Power Station stock until installation in the February 2006 refueling outage. Failure of the connection resulted in a loss of power to the safety-related 120 VAC bus. The intermittent nature of the connection allowed power to return to the inverter.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

SAFETY ANALYSIS

No significant safety consequences resulted from this event because all required safety systems were available and functioned as designed within safety limits.

This reactor scram event and plant response were compared to similar previous events and to transients in Chapter 15 of the Clinton Power Station Updated Safety Analysis Report and the General Electric Transient Safety Analysis Design Report. The plant response was similar to the previous events and evaluations. The fission product barriers (i.e., fuel clad, reactor pressure boundary, containment) were not challenged during this event. No MSIV closure or SRV lifts occurred and pressure control remained on the main turbine bypass valves.

This report also constitutes a notification under 10 CFR 21. The NSPS inverters feed the logic for Emergency Core Cooling Systems. The failure of an inverter could result in the loss of some redundancy for initiating Emergency Core Cooling Systems.

No safety system functional failures occurred during this event.

CORRECTIVE ACTION

The backplane circuit board assembly has been replaced and the Division 4 NSPS inverter has been restored to service.

The original backplane circuit board of same vintage in the Division 3 NSPS inverter will be replaced with a new board.

The purchasing description for backplane circuit boards will be revised to disallow boards with original (pre-modification) bare board design.

PREVIOUS OCCURRENCES

On March 26, 2006, the Division 4 NSPS inverter failed and did not re-power. This inverter failure did not result in a reactor scram, but some similar NSPS actuations occurred including an automatic start of the HPCS pump (without injection). An exact cause of the inverter failure could not be identified for this occurrence but was thought to be a circuit card failure; however, the cause is now concluded to be the same backplane circuit card inadequate solder joint as the cause of the August 27, 2006 event. (IR 470883)

COMPONENT FAILURE DATA

Manufacturer	Nomenclature	Manufacturer Model Number
Elgar	NSPS 1D Inverter Backplane Circuit Board	INV-752-1-101 Part Number 642-102-41

SUMMARY OF COMMITMENTS
Clinton Power Station
U-603789

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITMENT TYPE	
	ONE-TIME ACTION (Yes/No)	Programmatic (Yes/No)
This document has no regulatory commitments		